

REMARKS

The Examiner is thanked for the careful examination of the application. However, in view of the foregoing amendments and the remarks that follow, the Examiner is respectfully requested to reconsider and withdraw the rejections.

Aomori:

Claim 1 has been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,623,183, hereinafter Aomori. Aomori discloses a robot hand that includes a bevel gear 24 mounted on a motor shaft, and which is engaged with a driven-side bevel gear 18 that is mounted on an intermediate shaft. The bevel gear is coaxially and integrally attached to coupling gear 18. See column 2, lines 46-48. A base of the finger 9 includes external teeth 12 which engage with the coupling gear 15 so as to effect movement of the finger unit. Accordingly, to manipulate the finger unit, two different gearing engagements must occur. Specifically, there must be a gearing engagement between bevel gears 24 and 18, and a gearing engagement between coupling gear 15 and external teeth 12 of the finger unit. At each of the engagements, backlash may occur. Accordingly, fine adjustment of the finger unit 9 is difficult in the Aomori device in view of the fact that there are two locations where backlash may occur.

In contrast to Aomori, according to claim 1, a drive-side bevel gear is fixed to the rotational output shaft of the actuator. A driven-side bevel gear is engaged with a drive-side bevel gear, and is coaxially fixed on an external peripheral surface of the joint shaft. The joint shaft is rotatably supported in a direction perpendicular to a center axis line of the rotational output shaft of the actuator. In addition, a

connecting member is also rotatably fixed to the joint shaft and extends in a direction perpendicular to the joint shaft. The finger main body is also defined as being rotatably fixed to the connecting member. Thus, the finger main body can be manipulated by the actuator using only one gearing engagement between the drive-side bevel gear and the driven-side bevel gear in view of the fixed engagements of the connecting member to the joint shaft and the finger main body to the connecting member.

The Examiner alleges that joint shafts in Aomori are rotatably supported at both ends of the bearings 5a, 5b, 6a, 6b, as illustrated in Figure 2A. However, the Examiner further alleges that the joint shafts are the horizontal shafts illustrated in Figure 2B. The bearings 5a, 5b identified by the Examiner support rotation between the rotating members 2, 3, and 4. They are not arranged so as to support the horizontal shafts illustrated in Figure 2B. Accordingly, the structure in Aomori that is alleged by the Examiner to correspond to the joint shaft is not supported at both ends by bearings that are mounted as defined in claim 1.

The Examiner further alleges that the structure in Aomori that corresponds to the claimed connecting member is the brackets that are illustrated at the root of the fingers. It is assumed that such brackets are the unmarked brackets illustrated in Figures 1 and 3A. If this conclusion is not correct, the Examiner is respectfully requested to clarify this portion of the rejection. However, such structure is not rotatably fixed to the joint shafts, as defined in claim 1.

Accordingly, claim 1 is clearly patentable over Aomori.

Mimura:

Claims 1 and 3 have been rejected under 35 U.S.C. §102(b) as being allegedly anticipated by U.S. Patent No. 5,437,490, hereinafter Mimura. In Mimura, the actuator 31 drives shaft 1S through a pair of bevel gears. And, shaft 1S is connected to the outer casing of the finger module through the harmonic drive mechanism 34. See column 5, lines 50-56. Accordingly, the finger main body is not rotatably fixed to a connecting member which is rotatably fixed to the joint shaft. Instead, there are gearing connections between the shaft 1S and the finger main body, all of which could create undesirable backlash. Accordingly, in view of the amendments, claim 1 is clearly patentable over Mimura. With regard to claim 3, the Examiner's attention is directed to the comments above concerning claim 1.

likura/Aomori:

Claim 1 has been rejected under 35 U.S.C. §103 as being unpatentable over likura in view of Aomori.

The description of likura in the Office Action is technically inaccurate. Specifically, the Office Action refers to a rotational output shaft 33. However, a careful review of likura indicates that the shaft 33 in likura is a linear actuator that reciprocates in a linear direction. Rod 33 does not rotate. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 1 based on likura in view of Aomori.

Mimura/Langer:

Claim 2 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Mimura in view of U.S. Patent No. 4,496,279, hereinafter Langer. The

Examiner relies upon Langer for its alleged teaching of a spring plate. Accordingly, Langer does not otherwise overcome the deficiency discussed above with respect to the rejection of claim 1 based on Mimura. Since claim 2 depends from claim 1, claim 2 is also patentable over the combination of Mimura and Langer.

Aomori/Arbrink:

With regard to claim 4, the Examiner relies upon Arbrink for an alleged teaching of a compact gear system intended for rotating the arm of an industrial robot. However, Arbrink does not overcome the deficiency of Aomori set forth above with regard to the rejection of claim 1, from which claim 4 depends. Accordingly, claim 4 is also patentable over the combination of Aomori in view of Arbrink.

Aomori:

Claim 5 has also been rejected under 35 U.S.C. §103(a) as being unpatentable over Aomori. The Examiner recognizes that Aomori does not disclose the "duplication" of the members of claim 1, but alleges incorrectly that it would have been obvious to one of ordinary skill in the art to duplicate these essential members along the finger for more versatile pivotal movement, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. Applicant submits that it is difficult or impossible for the prior art to connect a similarly structured finger unit on the tip end of the finger unit so that a multi-joint finger can be obtained. In addition, the Examiner's attention is directed to the remarks set forth above with respect to claim 1.

In view of the foregoing amendments and remarks, the Examiner is respectfully requested to reconsider and withdraw the outstanding rejections, and to consider the Information Disclosure Statement submitted concurrently herewith.

In the event that there are any questions concerning this Amendment, or the application in general, the Examiner is respectfully urged to telephone the undersigned attorney so that prosecution of the application may be expedited.

Respectfully submitted,

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